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June 13, 1945.
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Messrs. J. H. Arnold
C. Daniel
C. A. Johnson
A. M. Squires
H. N. Woebcke

1944

PROGRAM FOR DEVELOPING PROCEDURE FOR MAKING MATERIAL BALANCES IN K-25 PLANT

In accordance with Mr. Arnold's request of May 19, a preliminary survey has been made of the problem of accounting for T and X in the K-25 plant. This problem is of importance for the following reasons:

(1) Knowledge of the amount of T and X in process in the main diffusion cascade is helpful in planning the most efficient production from the plant.

(2) When operation of the plant becomes routine, strict accountability for T and X will undoubtedly be required by the Army.

(3) Examination of all sources of T inventory and T loss will disclose means for improving plant performance.

(4) Unaccounted losses of T will provide an indirect measure of destruction of C-616 within the plant.

The group now working on this problem includes Mr. C. Daniel, Dr. C. A. Johnson, Mr. A. M. Squires, Mr. H. N. Woebcke and the writer. Meetings were held in New York on May 30 and at site on June 8 and 9. The problem has been broken down into four topics, to be investigated as described in the following paragraphs.

1. Assay Requirements for Material Balances in K-25 Plant

Mr. C. Daniel will investigate the precision of isotopic analysis required to prepare significant material balances on the K-25 plant. This investigation will set analytical requirements compatible with the limitations of methods now in use and with the magnitude of errors inherent in measuring other quantities entering plant material balances. The results of this investigation will be summarized in a memorandum by Mr. Daniel.

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2. Sampling Procedures for Material Balances in K-25 Plant

Mr. C. Daniel will examine procedures which may be used for sampling C-616 in process in the main cascade. He plans to prepare a memorandum recommending the location of sampling points, the frequency of sampling at each point, the interval of time during which each sample is taken, and any special precautions which may usefully be observed during sampling. The procedure recommended will be aimed at the same degree of precision in sampling as can be obtained in measurement of T inventory and flow rates and in isotopic analysis.

3. Procedure for Taking Visible X Inventory in K-25 Plant

Experience in operating the K-25 plant has already demonstrated the necessity of keeping day-to-day records of the amount of T and X in active cells of the main diffusion cascade. This amount is a measure of the potential productive capacity of the plant during the period immediately following the inventory.

Two types of data required for taking the visible X inventory are the assay of cell contents and the T inventory. Means for securing assay data will have been treated under topics 1. and 2. above.

T in the main diffusion cascade will be found in intercell and interbuilding lines and in onstream cells. The amount of T in intercell and interbuilding lines will be estimated from the volume of these lines and the temperature, pressure, and G-74 content of the C-616 contained in them. Tabular means for rapidly computing the T inventory of these lines will be developed by the Process Division in New York.

The T inventory of cells will depend on the following variables:

(1) Tails pressure of each stage

(2) Tails temperature of each stage

(3) Heads G-74 content of each stage

(4) Barrier permeability of each stage, as inferred from control valve angle

(5) Frequency (to be assumed 60 or 120 cycles)

At a meeting on June 9 attended by Messrs. C. Daniel, C. A. Johnson, S. Cromer and C. H. Rucker, Mr. Rucker agreed to calibrate a typical cell in each of Section -3, Section -2, 2a or 2b, Section 1 or -1, Section 3a or 3b, and Section 4 for C-616 inventory at a limited number of sets of values of the principal variables listed above, by procedures to be recommended by Dr. Johnson and Mr. Daniel. The Process Division in New York, under Mr. Squires' direction, will prepare charts for estimating the T inventory of cells at any conditions from the results of calibrations at a limited number of conditions.

Finally, Mr. Daniel will prepare a memorandum recommending a procedure for taking inventory of visible T and X in Section 300, in which

measurements and computations are simplified as far as is compatible with the precision desired.

4. Procedure for Taking Overall T and K Material Balances in K-25 Plant

For an overall material balance, it has been agreed that material will be assumed to enter or leave the plant at the following points:

(a) Feed drums crossing scales in Temporary Feed Vaporizer, Building K-300-1.

(b) Waste drums crossing scales in Section 400.

(c) Product cylinders as weighed leaving Section 300.

(d) Contents of spent carbon traps at time traps are dumped.

All other material treated within the plant is to be accounted for by a complete inventory at specified material balance dates. A partial list of sources of T to be inventoried and assayed follows.

(a) Main cascade, Section 300

(b) Cold traps

(c) Carbon traps

(d) Liquid C-616 accumulators

(e) Mobile units

(f) Beach-Russ pumps

(g) Line recorder mercury traps

(h) Line recorder cold traps

(i) Laboratory samples

Dr. Johnson's group will investigate other possible sources of T to be inventoried.

In accordance with paragraph 3., the Process Division in New York will recommend procedures for taking inventory of the main cascade, Section 300. Mr. Daniel, working with other members of Dr. Johnson's group, will recommend procedures for determining the T inventory and assay of all other sources of T. As a general rule, it is recommended that as much T as possible be either shipped from the plant or returned to the main cascade just before a complete inventory is to be taken. Thus, cold traps and Beach-Russ pumps should be stripped, spent carbon traps should be dumped, liquid C-616 accumulators should be drained, etc.

In setting up procedures, recognition will be given practical difficulties and the precision required in making overall material balances.

After satisfactory procedures have been worked up for determining the T inventory and assay of all equipment in the plant, Messrs. Daniel, Johnson, Wesbeke, Squires and Benedict will prepare a report recommending a detailed procedure for making T and K material balances. This report will set the interval over which significant material balances may be taken and will estimate the precision attainable by procedures which are feasible with existing equipment and operating practices. A description will also be given of means which could be used for improving the precision of material balances by means of new equipment or new operating practices.

M. Benedict

M. Benedict

MB:rsv